



A practical way to implement ISO 15288 V&V processes: The V&V Studio



2nd & 4th June, 2020

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Presenters' profile

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Webinar information



The REUSE Company



V&V Processes ISO 15288



Next Webinar



V&V Studio – Automating V&V





01 The company was created in **1999**

As a spin-off of a University in Europe

02 **System + Software Engineers**

Smart combination between Company staff and R&D from Academia

03 **Headquarters:** Madrid (Spain)

International offices:
Stockholm (Sweden)
Tokyo (Japan) Delegation

2021:
USA
Chicago/Detroit/Miami

04 To promote a **reusable, scalable** and global solution to a **smart** and **interoperable** Systems Engineering environment, by offering a **semantic knowledge centric** approach.



Research and Innovation in our DNA

Spin-off of Carlos III University of Madrid

TRC's headquarter is in the Legatec Technology Park of the University

≈10% of revenues are devoted to R&D

TRC is actively involved in several large EU research projects



REVaMP²

Past

ARTEMIS CRYSTAL
Requirements
Engineering



AMASS
Assurance and Certification of CPS



ARROWHEAD

Current

Celtic+: IoD



Smart Connected World



ITEA3

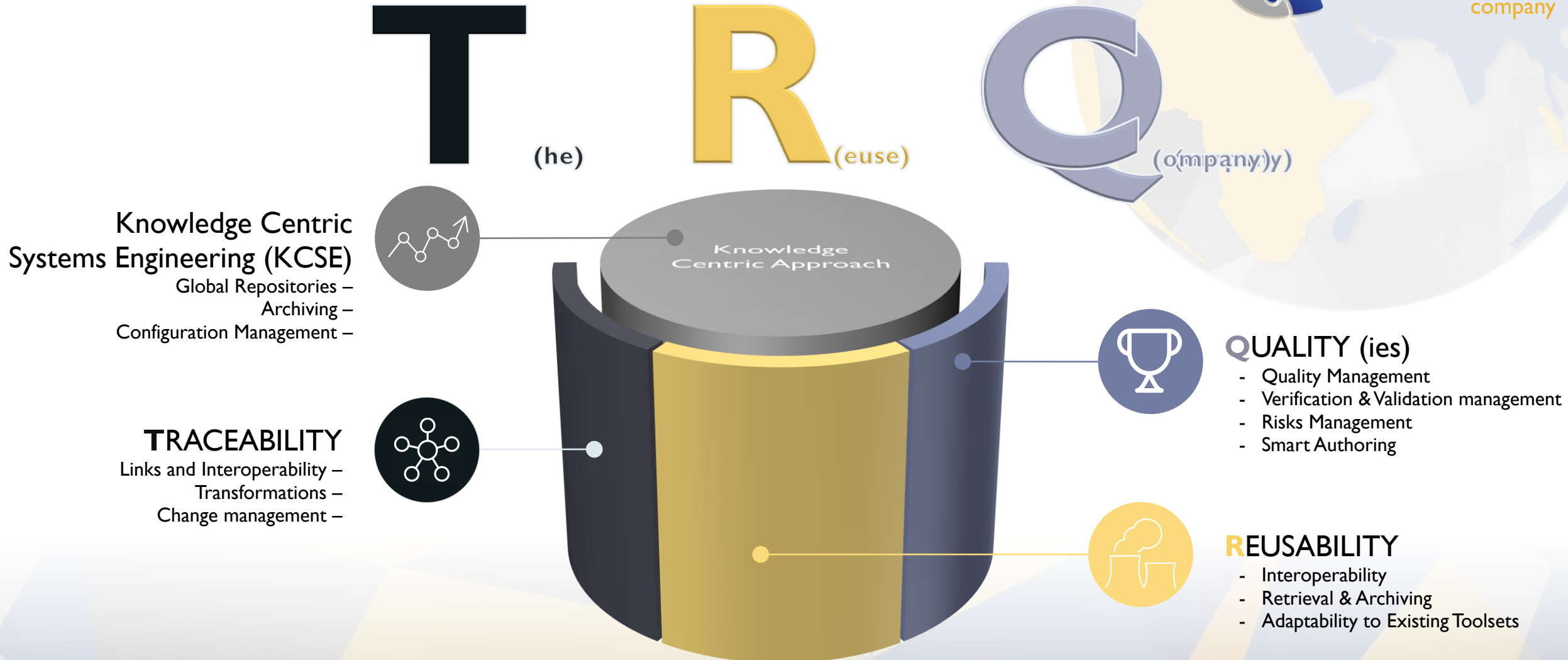
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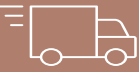


IREL 4.0
VALUE 3S



ECSEL JU





	Aerospace and defense
	Energy
	Automotive
	Healthcare
	Other industries



- ▶ SE Professor at Universidad Carlos III de Madrid (Spain)
- ▶ CTO at The REUSE Company
- ▶ Former President of AEIS (INCOSE Spain)
 - ▶ Member of INCOSE and AEIS
 - ▶ Former INCOSE Ontology Working Group Chair
 - ▶ Member of INCOSE Requirements Engineering WG
 - ▶ Contributor (review) to INCOSE Guide for Writing Requirements
 - ▶ Certified Systems Engineering Professional (CSEP)
 - ▶ Expert Systems Engineering Professional (ESEP)

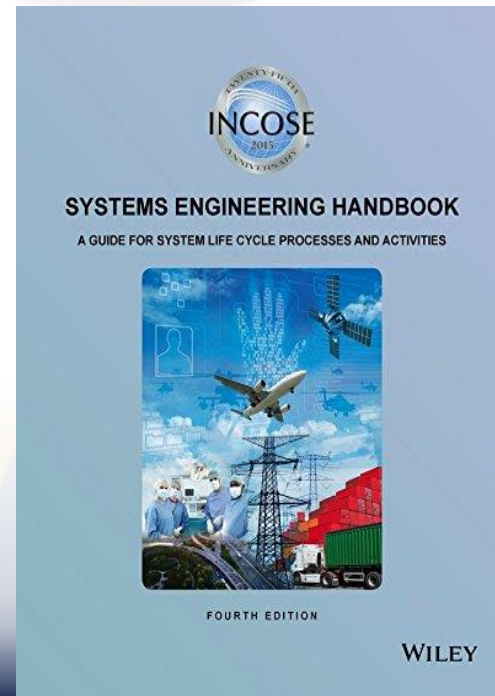
Dr. Juan Llorens BIO



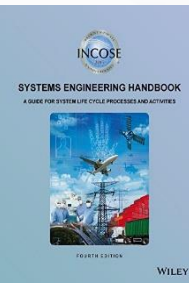
Dr. Juan Llorens

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V&V (Verification and Validation) Processes

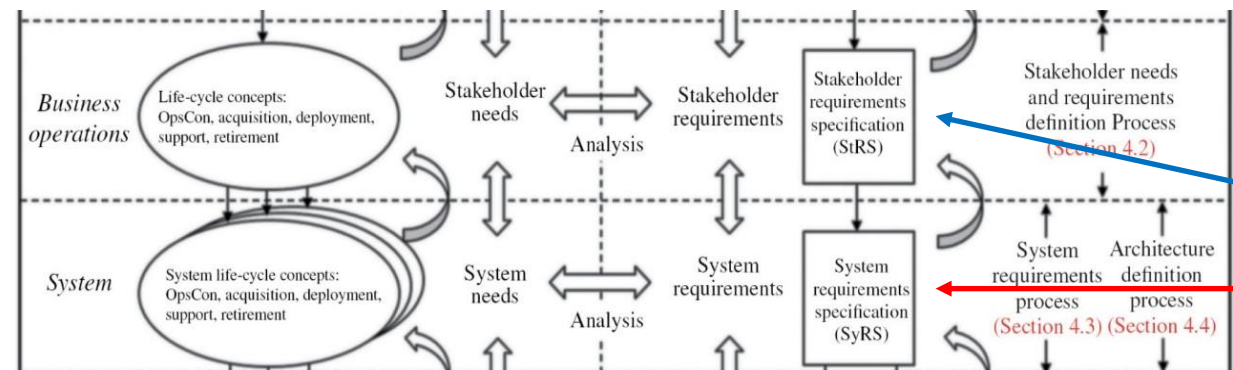


- *“The purpose of the Verification process is to provide objective evidence that a system or system element fulfils its specified requirements and characteristics.” (SEHb p.83)*

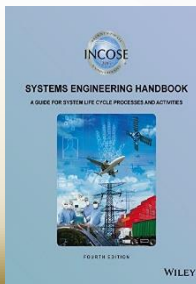


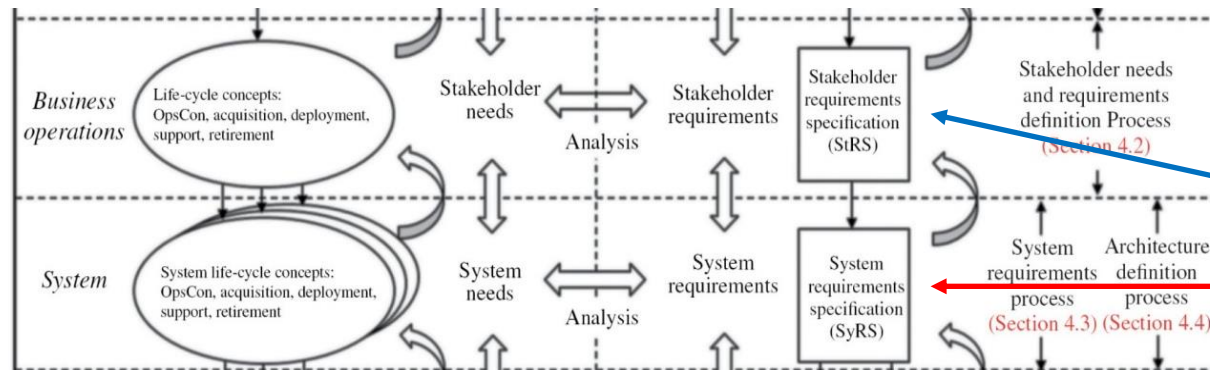
- *“The purpose of the Verification process is to provide objective evidence that a system or system element fulfils its specified requirements and characteristics.” (SEHb p.83)*
- *“The purpose of the validation process is to provide objective evidence that the system, when in use, fulfills its business or mission objectives and stakeholder requirements, achieving its intended use in its intended operational environment”. (SEHb p.89)*

- “The purpose of the Verification process is to provide objective evidence that a system or system element fulfils its specified requirements and characteristics.” (SEHb p.83)
- “The purpose of the validation process is to provide objective evidence that the system, when in use, fulfils its business or mission objectives and stakeholder requirements, achieving its intended use in its intended operational environment”. (SEHb p.89)



Source: Mike Ryan - > SE Handbook V4





Source: Mike Ryan - > SE Handbook V4

Validation

Verification



- Verification and Validation are not the same (“*build the thing right*” vs “*build the right thing*”):
 - Context is (very) different
 - Scope is different
 - ... even if both use the same methods and tools
 - Therefore, for the purpose of this presentation, We’ll center our message in the Verification Process
 - Assuming that everything can be applied to both V&V



- The INCOSE Systems Engineering handbook (V4) states the focus in a more precise way:
 - “The verification process can be applied to any engineering element that has contributed to the definition and realization of the system itself (e.g., verification of a system requirement, a function, an input/output flow, a system element, an interface, a design property, a verification procedure)”. (SEHb p.83)
- This statement widens the Verification process goal to what it really stands for:
 - To provide objective evidence that whatever engineering item (requirement, requirements set, model element, model(s), function, etc.), system element or the SOI itself has been **“built right”**.
- The result is that the Verification process must be applied universally and transversely both R2L of the V-Model (the most known) as well as L2L (or even R2R)

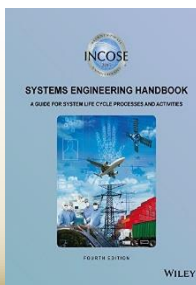


Verify the Requirements against the SOI / SE?

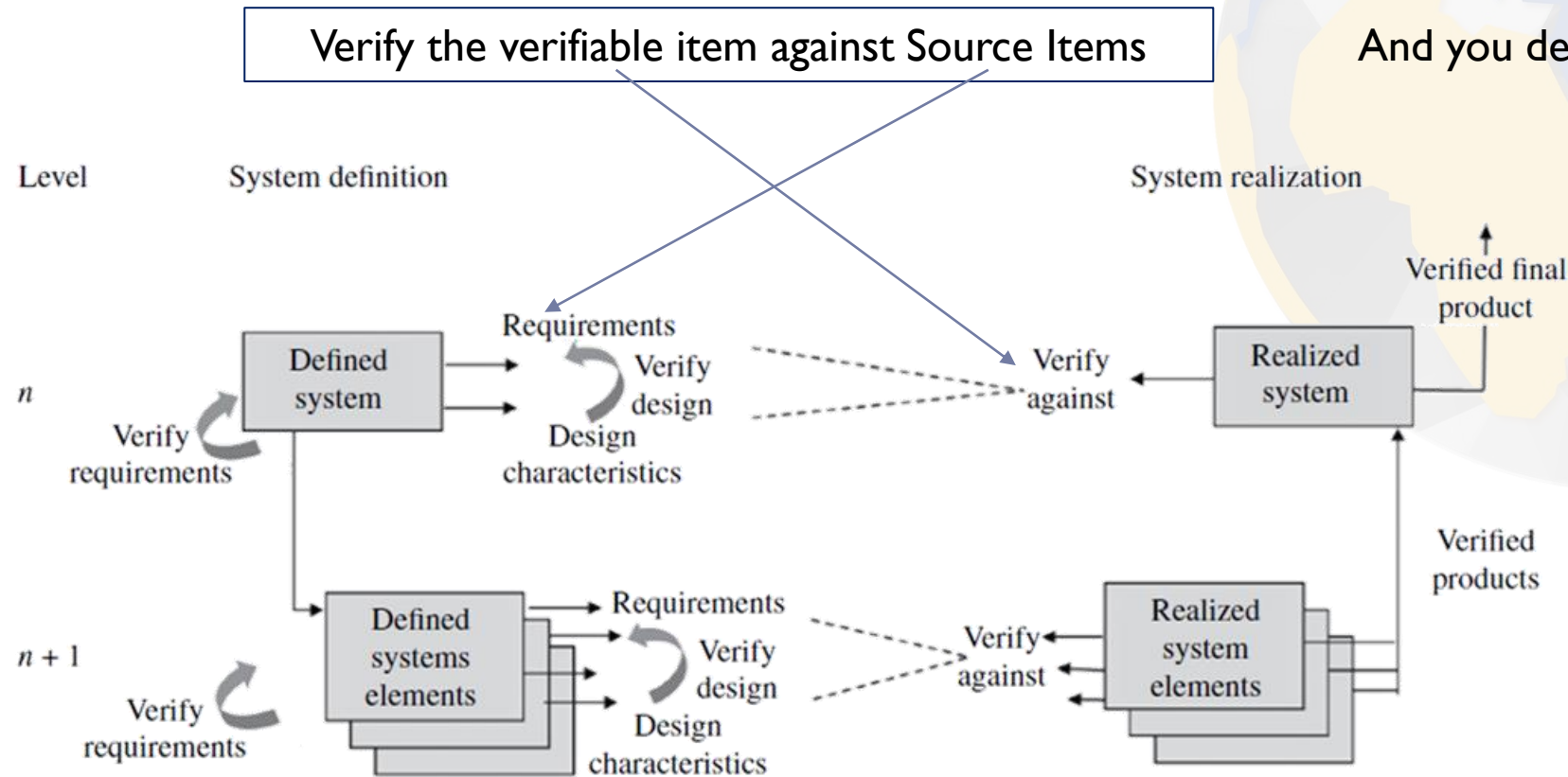
Verify the SOI / SE against the Requirements?

Items	Explanation for Verification
Document	To verify a document is to check the application of drafting rules.
Stakeholder Requirement and System Requirement	To verify a stakeholder requirement or a system requirement is to check the application of syntactic and grammatical rules, characteristics defined in the stakeholder requirements definition process, and the system requirements definition process such as necessity, implementation free, unambiguous, consistent, complete, singular, feasible, traceable, and verifiable.
Design	To verify the design of a system is to check its logical and physical architecture elements against the characteristics of the outcomes of the design processes.
System	To verify a system (product, service, or enterprise) is to check its realized characteristics or properties against its expected design characteristics.
Aggregate	To verify an aggregate for integration is to check every interface and interaction between implemented elements.
Verification Procedure	To verify a verification procedure is to check the application of a predefined template and drafting rules.

https://www.sebokwiki.org/wiki/System_Verification



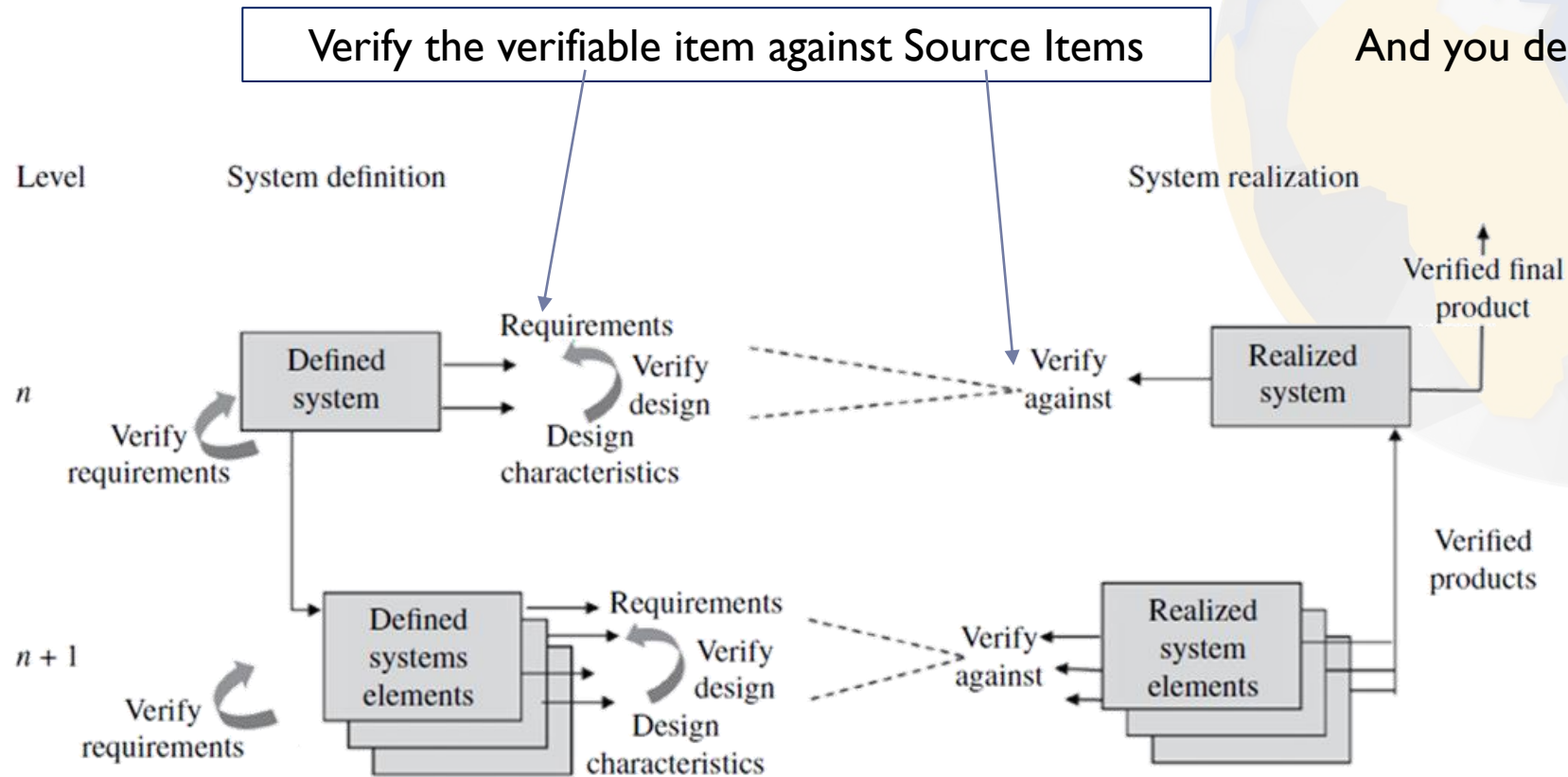
And you decide your way 😊



Why the debate?
For Tool Vendor to decide meta-model

Source: Systems Engineering Handbook V4 - Fig 4.15 p.87

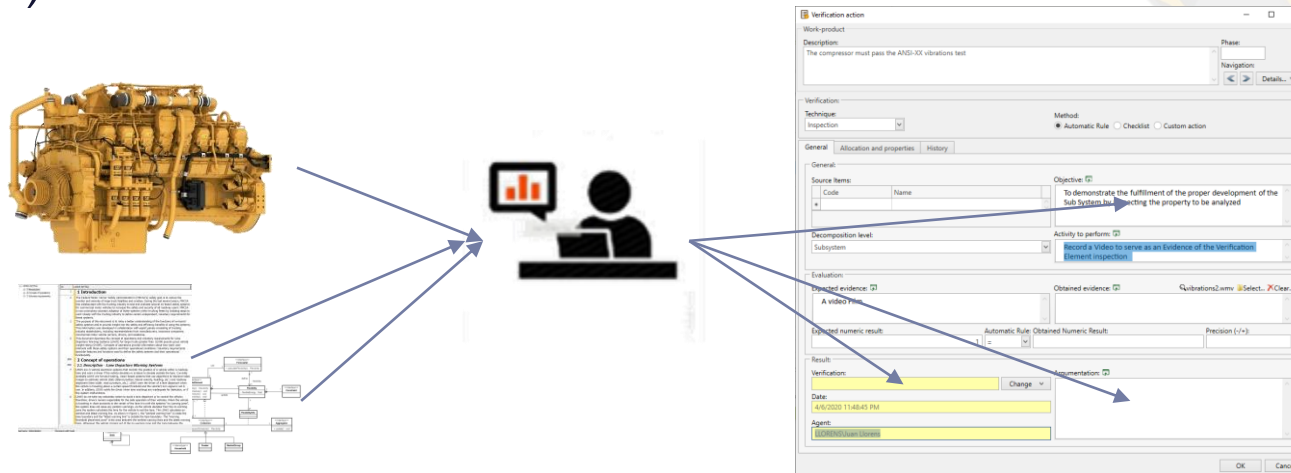
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Why the debate?
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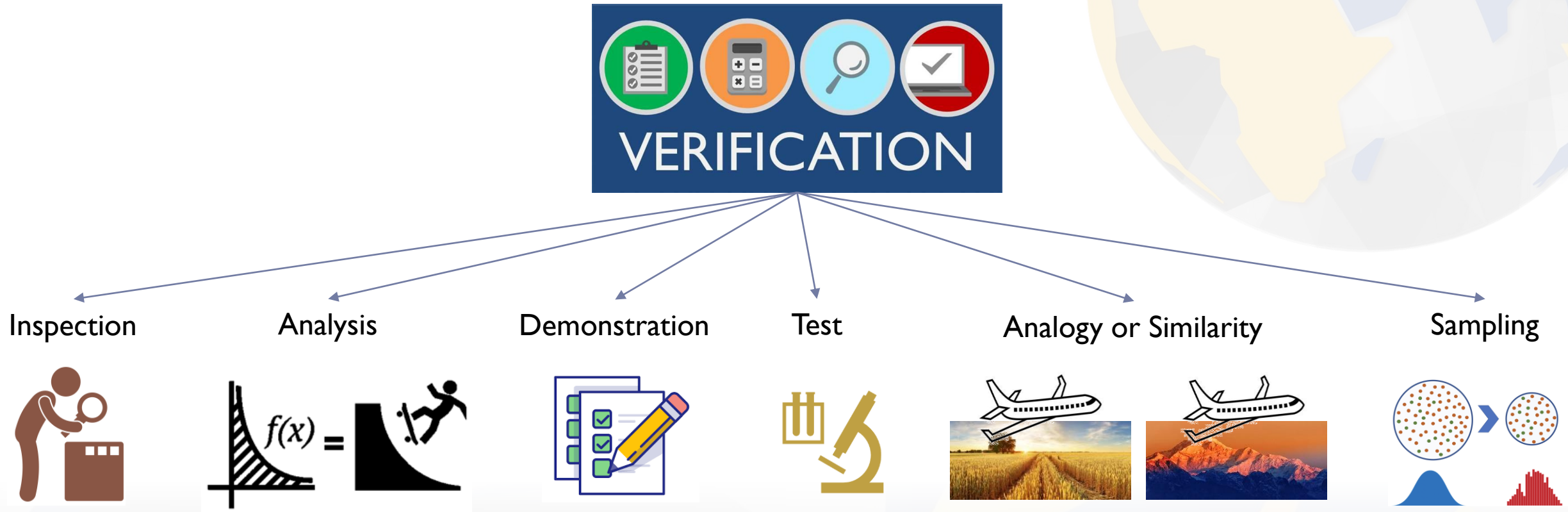
- The Verification Process implementation evolves around the notion of **VERIFICATION ACTION**.
- A Verification Action defines a structured representation (digital) of what is considered necessary to assure that the verified element fulfils its specified requirements and characteristics.
- The Verification Action (VA) is intended to serve as a mean to provide objective evidence that a work-product has (or has not) been verified.



- The process of defining, configuring, scheduling, filling, analyzing, managing and reporting VAs is called the **Verification Process**

Attribute	Description	Attribute	Description
<i>Verifiable Item</i>	The work-product that is being verified It responds to the question: What product is verified?	<i>Activity to Perform</i>	Description of the work to be done within the verification action.
<i>Source Items:</i>	The engineering items that serve as source information It responds to the question: which item(s) should be taken as reference to verify the verifiable item?	<i>Expected Evidences (Expected Results)</i>	The expected results of the verification. Indicates the objective evidence that should be compared with the obtained results for verification confirmation (or rejection, if not enough).
<i>The verification technique(s) to be used</i>	Several options are supported in the literature: Inspection, analysis, demonstration, test, analogy or similarity, simulation, sampling, other	<i>Expected Numeric Result</i>	Represents the expected numeric results as a quantitative value. It can be used for automating purposes
<i>Decomposition Level of the System</i>	SOI, sub-system (intermediate system element), component (leaf level system element).	<i>Obtained Evidences (Obtained Results)</i>	The results of the verification. Indicates the obtained objective evidences that serve for verification confirmation against the expected evidences (or rejection if not enough).
<i>Phase</i>	Phase in which the verification will be performed. This attribute allows to define dependencies between the verification actions so that they can be performed in a defined order	<i>Obtained Numeric Result</i>	The actual result of the verification but using a quantitative value. It can be used for automating purposes, like automatically comparing this value with the expected result and providing a candidate verification value.
<i>Objective</i>	What is to be accomplished by the verification process. In the case of engineering items, this attribute represents the reference used to define the expected result	<i>Performing Organization or Person</i>	Organization responsible for leading the verification activity.

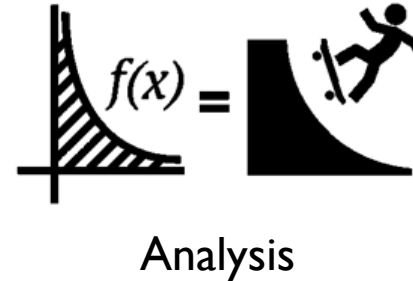
Attribute	Description	Attribute	Description
<i>Starting Date</i>	Date when the verification activity started.	<i>Funds Resource</i>	Numeric value that manages the real money devoted to the verification.
<i>Ending Date</i>	Date when the verification activity ended.	<i>Facility Resource</i>	Facility, laboratory or SW tool used to perform the verification activity.
<i>Estimated Time Resource (Days)</i>	Numeric value for the expected time to be devoted to the verification.	<i>Verified</i>	Represents information about the state of the verification action. The most usual states are Yes and No values: Yes if the work-product has been verified (true) and No if the work-product has not been verified (false). However, as you'll see later, V&V Studio supports several different states (See section 6.3 How Is the Verification Execution in V&V Studio).
<i>Estimated Labor Resource (Hours/Person)</i>	Numeric value for the expected hours/person to be devoted to the verification.	<i>Verified Date</i>	Date when the verification activity ended.
<i>Estimated Funds Resource</i>	Numeric value for the expected money to be devoted to the verification.	<i>Verified Agent</i>	Person that “certifies” the verification.
<i>Time Resource (Days)</i>	Numeric value that manages the real time devoted to the verification.	<i>Automatic Verification Rule</i>	Rule to be applied for comparing the Expected Numeric Result and the Obtained Numeric Result, in order to automatically suggest a value for the “Verified” attribute.
<i>Labor Resource (Hours/Person)</i>	Numeric value that manages the real hours/person devoted to the verification.	<i>Other attributes</i>	Customized attributes from the user. They can vary for every different verifiable item type.





Inspection

- Based on visual or dimensional examination of an element
- Relies on the human senses
 - or uses simple methods of measurement and handling.
- Generally nondestructive
 - and typically includes the use of sight, hearing, smell, touch, and taste
- Simple physical manipulation / mechanical and electrical gauging / and measurement.
- No stimuli (tests) are necessary



- Based on analytical evidence
 - obtained without any intervention on the verifiable element.
- To show theoretical compliance => Mathematical or probabilistic calculation, logical reasoning (including the theory of predicates), modelling and/or simulation under defined conditions.
- Mainly used where testing to realistic conditions cannot be achieved or is not cost-effective.





Demonstration

- Used to show correct operation of the submitted element against operational and observable characteristics without using physical measurements
 - (or minimal instrumentation or test equipment).
- Generally uses a set of actions, selected to show that the element response to stimuli is suitable
 - or to show that operators can perform their assigned tasks when using the element.
- Observations are made and compared with predetermined/expected responses



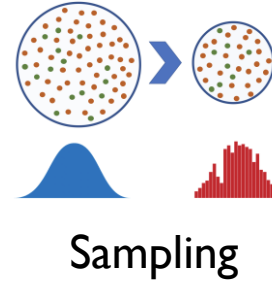
Test

- Performed onto the submitted element by which functional, measurable characteristics, operability, supportability or performance capability is quantitatively verified when subjected to controlled conditions that are real or simulated.
- Often uses special test equipment or instrumentation to obtain accurate quantitative data to be analyzed.



Analogy or Similarity

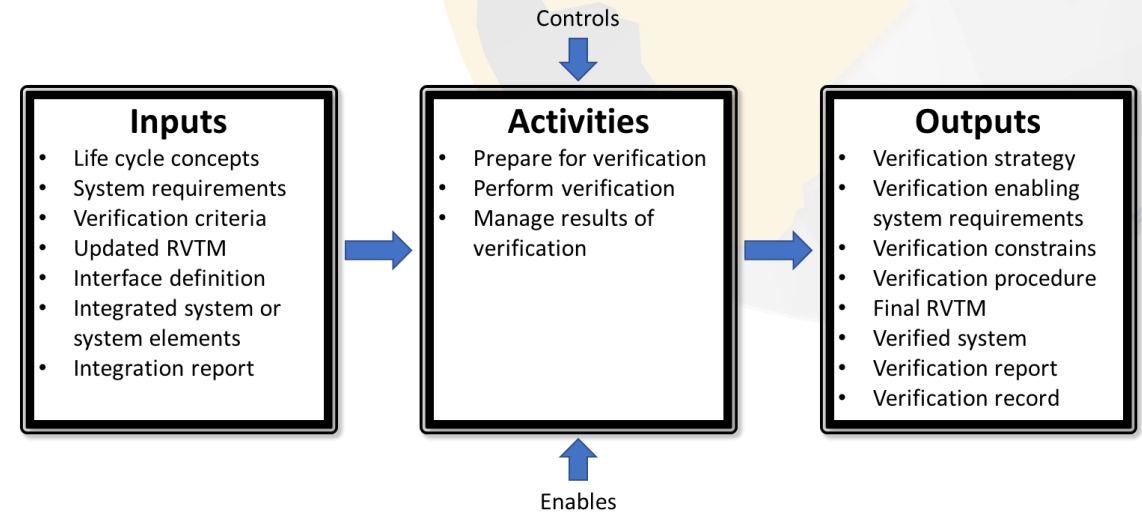
- Based on evidence of similar elements to the submitted element or on experience feedback.
 - It is absolutely necessary to show by prediction that
 - the context is invariant
 - the outcomes are transposable.
 - (e.g., models, investigations, experience feedback).
- Can only be used if the submitted element is similar in design, manufacture, and use.
- Equivalent or more stringent verification actions were used for the similar element.
- The intended operational environment is identical to or less rigorous than the one applied to the similar element.
- A kind of V&V Reuse.



- Based on verification of characteristics using samples.
- The number, tolerance, and other characteristics must be specified and in agreement with the experience feedback.

- A process is best defined using inputs, outputs and activities to be developed in it.
- Based on the ISO 15288 Standard, a good implementation of the Verification Process must support the realization of the following activities:
 1. Prepare for verification
 2. Perform verification
 3. Manage results of verification
- Next Section: A detailed description on how to implement the activities using the V&V Studio

Verification Process > Definition



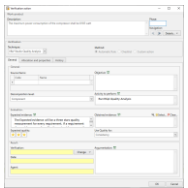
Prepare for Verification



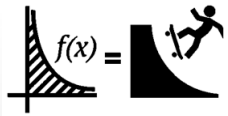
Select the Items to be Verified



Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.

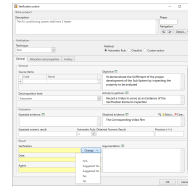


Define a Verification Action for each Verifiable Item

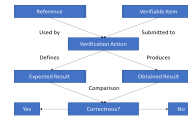


Define a Verification Technique for each Verifiable Item

Perform Verification



Execute the Verification Action for each Verifiable Item (fill the corresponding information)



Engineer applies the OK / KO decision process based on the standard guidelines.

Manage Results of Verification

Manage and record discovered anomalies



Track the Verification Process and manage Configuration



Build and maintain the RTVM



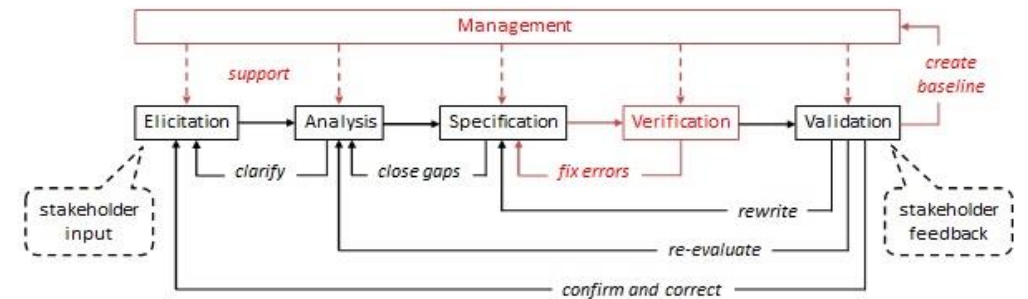
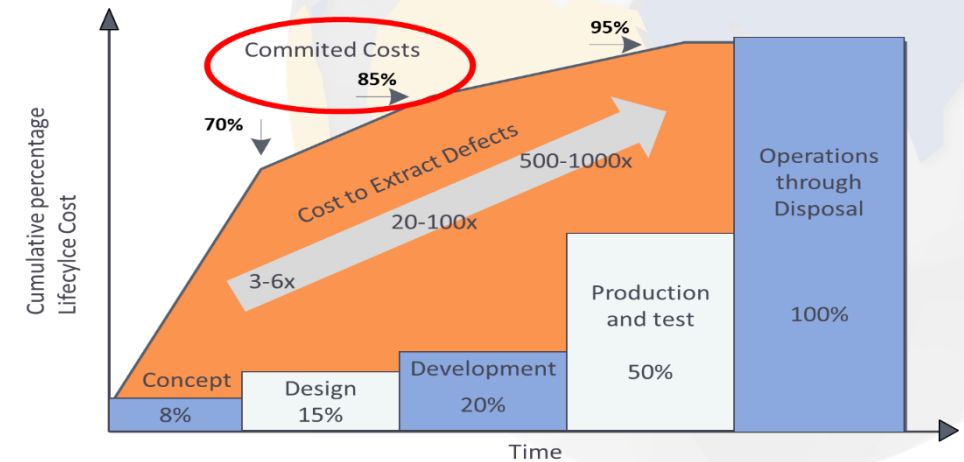
	Verification	Validation
Process Definition	<i>The purpose of the verification process is to provide objective evidence that a system or system element fulfils its specified requirements and characteristics.</i>	<i>The purpose of the validation process is to provide objective evidence that the system, when in use, fulfills its business or mission objectives and stakeholder requirements, achieving its intended use in its intended operational environment.</i>
Scope	<i>The verification process can be applied to any engineering element that has contributed to the definition and realization of the system itself (e.g., verification of a system requirement, a function, an input/output flow, a system element, an interface, a design property, a verification procedure).</i>	<p><i>The validation process is applied to a system of interest, or any system or system element that composes it, at the appropriate points in the life cycle stages to provide confidence that the right system (or system element) has been built.</i></p> <p><i>The validation process can be applied to any system element or engineering item of the system or its definition that has been defined or realized.</i></p>
Activities	<ul style="list-style-type: none"> • Prepare for verification • Perform verification • Manage results of verification 	<ul style="list-style-type: none"> • Prepare for validation • Perform validation • Manage results of validation
Conceptual Tool	<i>A verification action describes what must be verified (...), on which item (...), the expected result (...), the verification technique to apply (...), and on which level of decomposition of the system.</i>	<i>A validation action describes what must be validated, on which item, the expected result, the validation technique to apply, and on which level of the system hierarchy.</i>
How To	<i>The engineer performs verification by creating and managing verification actions as means to produce evidences.</i>	<i>The engineer performs validation by creating and managing validation actions as means to produce evidences.</i>

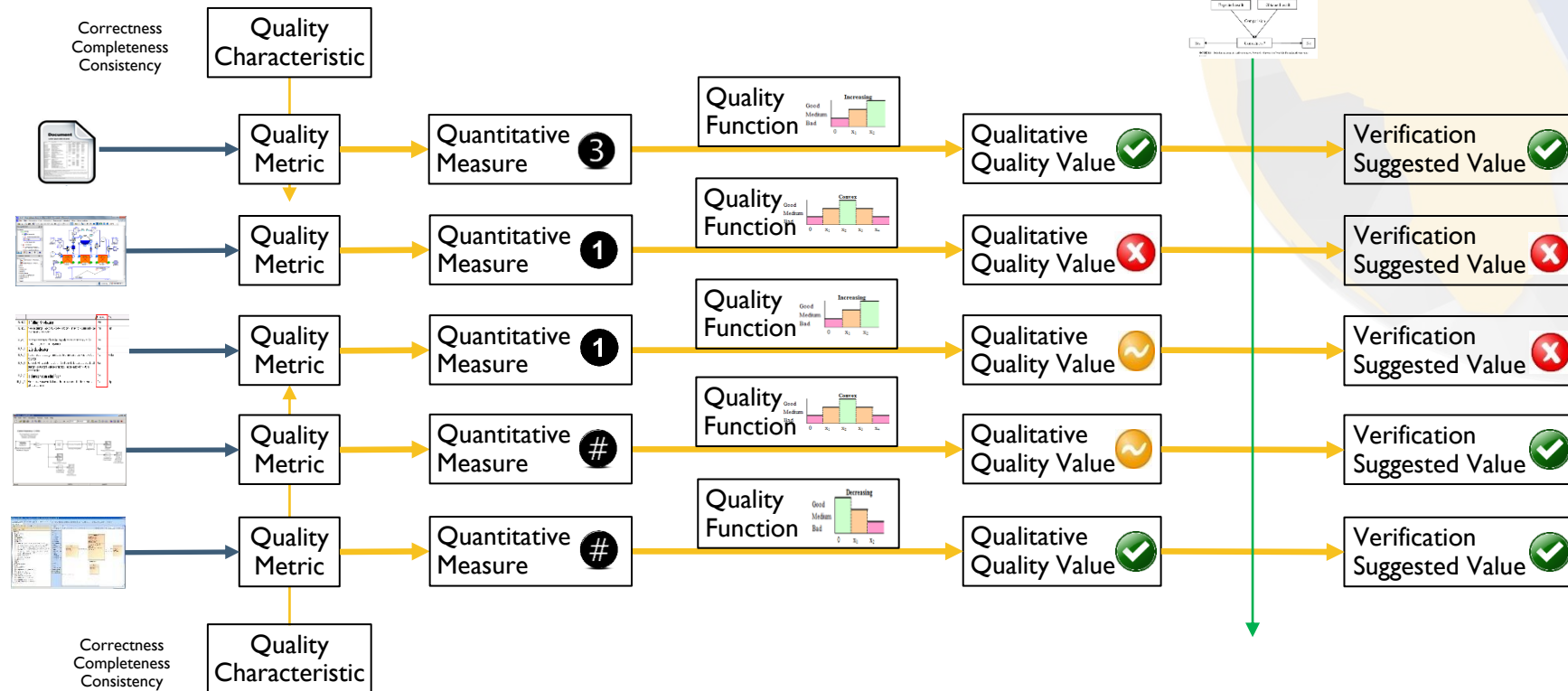


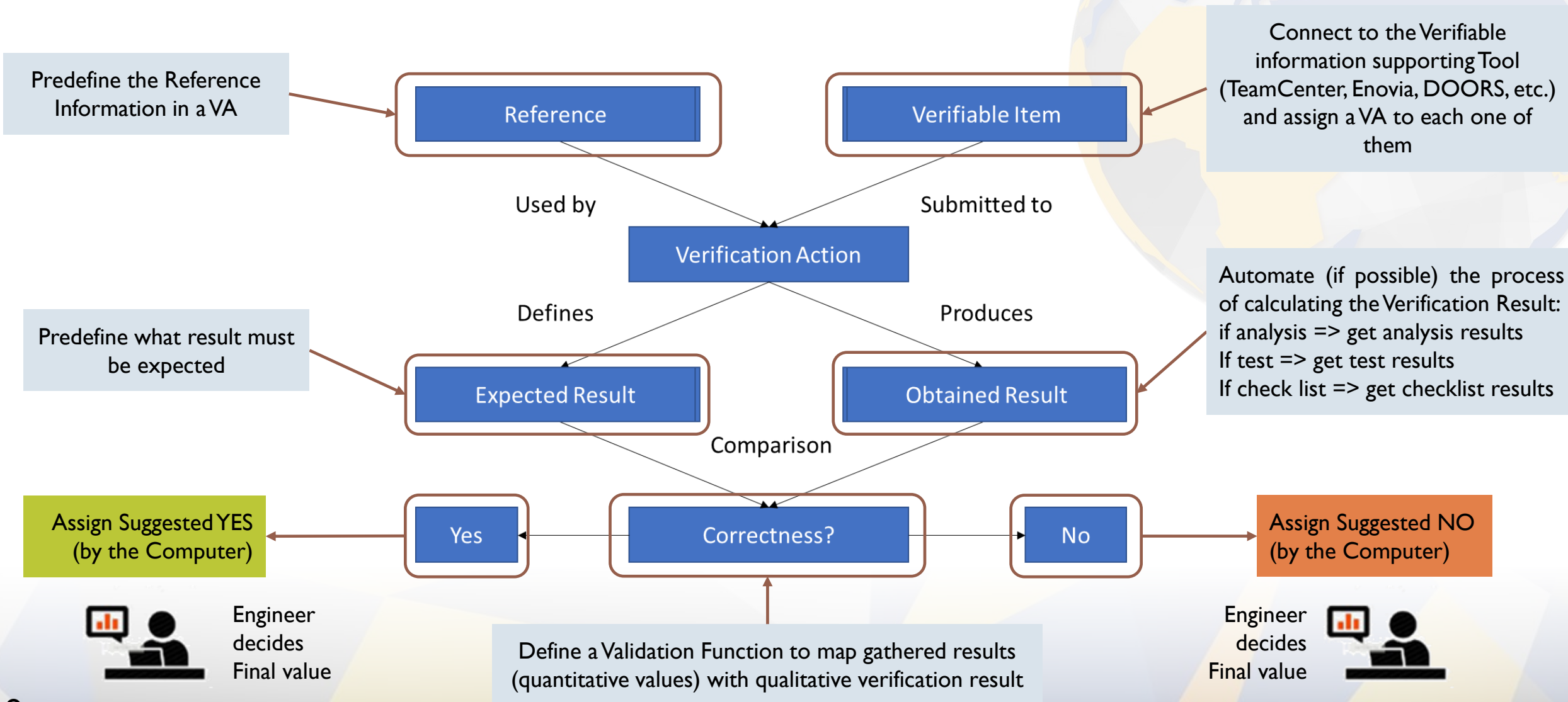
Automating the Verification Process (Connecting the notions of Quality and Verification)

- The universalization of the Verification process can be found in the notion of quality
 - the less defects of any type produced during all the different life-cycle stages ...
 - the better it will be to reduce cost, calendar time and quality... and V&V
- Combine Verification with Quality control + assurance is the kernel of this approach
 - One example of this combination is to apply the verification process to requirements; requirements must be validated, and (now recently) verified

Verification Process > Quality and Verification







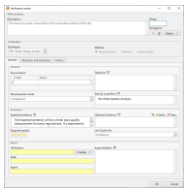
Prepare for Verification



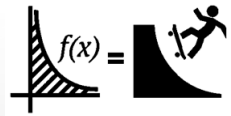
Select the Items to be Verified



Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.

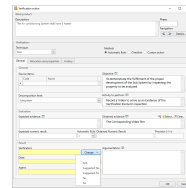


Define a Verification Action for each Verifiable Item

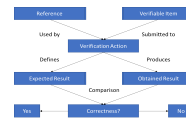


Define a Verification Technique for each Verifiable Item

Perform Verification



Execute the Verification Action for each Verifiable Item. If possible, the computer gathers the Information automatically



Computer applies the OK / KO decision process based on the standard guidelines.



Manage Results of Verification

Manage and record discovered anomalies and evidences



Track the Verification Process and manage Configuration



Build and maintain the RTVM



Provide proper reports



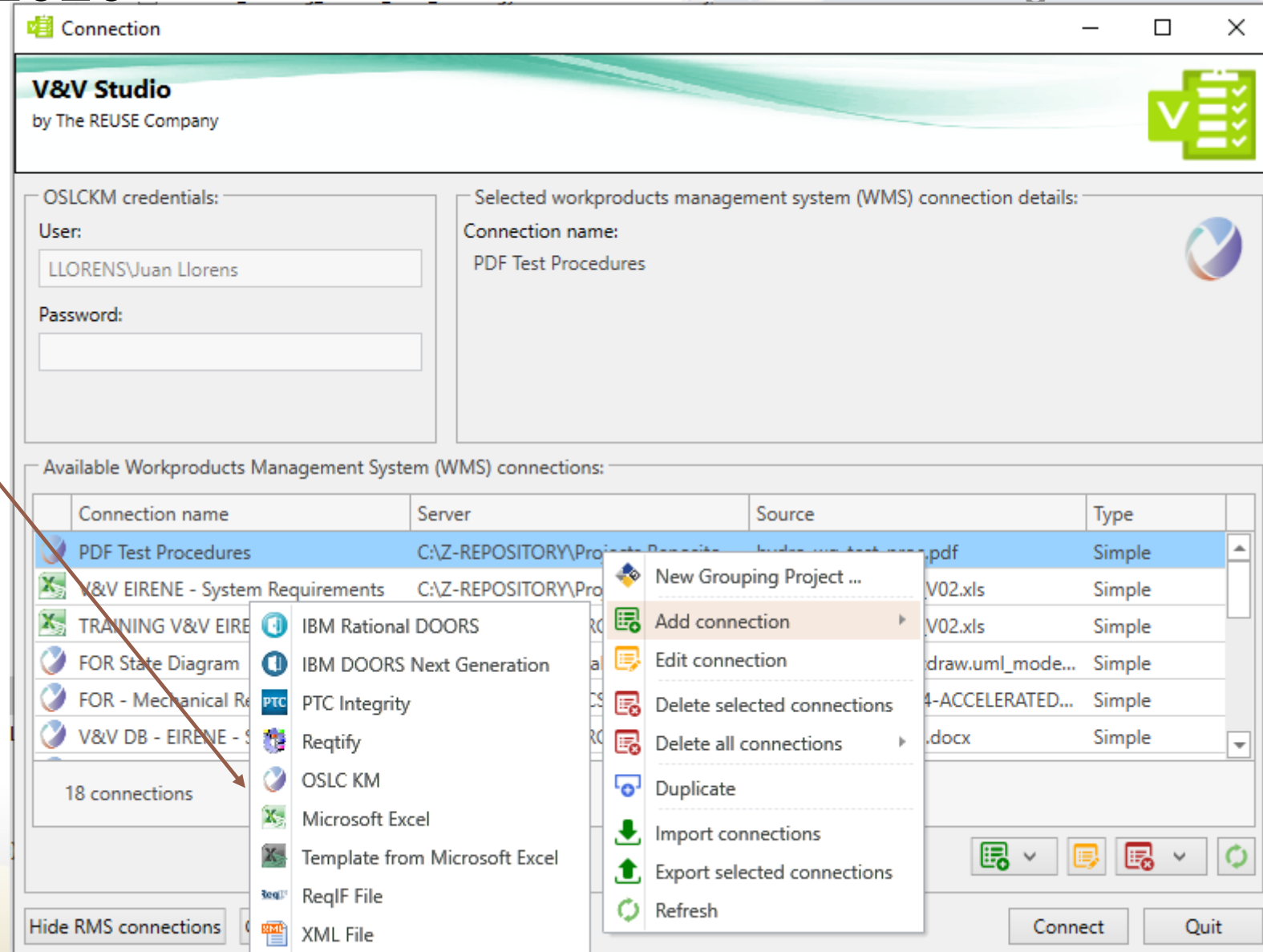
Prepare for Verification

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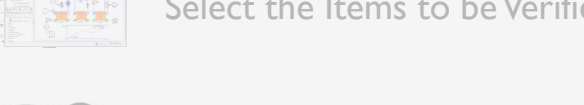
Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.

Define a Verification Action for each Verifiable Item

Define a Verification Technique for each Verifiable Item




Prepare for Verification

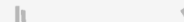
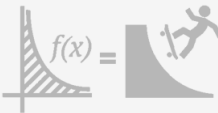
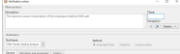
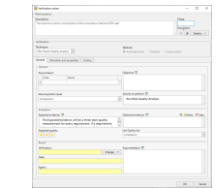


Select the Items to be Verified

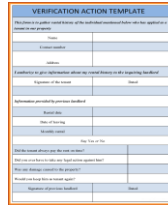
Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.



Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.



Define a Verification Technique for each Verifiable Item



By selecting a predefined VA template. i.e:

- By selecting a predefined VA template. i.e:
- Template for performing Inspection
 - Template for producing a Check list
 - Template for Simulation Analysis

Verification action baseline

Template:

Name: System Verification by Demonstration - BASELINE

Rationale: This technique is used to show correct operation of the submitted element against operational and observable characteristics without using physical measurements or test equipment.

Verification:

Technique: Demonstration

Method: ☒ Automatic Rule ☐ Checklist ☐ Custom action

Objective: This technique is used to show correct operation of the submitted element against operational and observable characteristics without using physical measurements (or minimal instrumentation or test equipment). It uses

Activity to perform: Create a video or take a picture demonstrating the property or characteristic verified in the System

Decomposition level: System of interest

Evaluation:

Expected evidence: A Recorded Video or Picture

Obtained evidence: Select... Clear...

Expected numeric result: Automatic Rule: Obtained Numeric Result: Precision (-/+):

OK Cancel

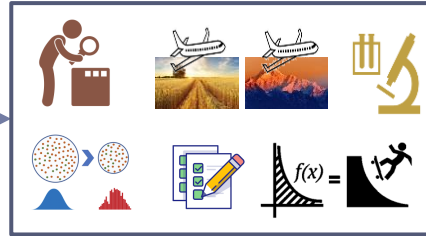
Prepare for Verification

Select the Items to be Verified

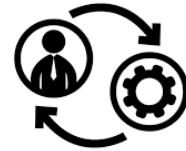
Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.

Define a Verification Action for each Verifiable Item

Define a Verification Technique for each Verifiable Item



Select a one Verification Technique or define your own one



Define If the obtained results will be gathered manually or automatically

- manually: (A human engineer fills data in the VA manually)



Defining customizable Check-lists



Defining values to be expected

- automatically (a **Calculation Function** gets the obtained data into the VA)



Connecting to other tools



Calculating the Quality of Verifiable Item using RQA Tool



Defining your own Calculation Function



Prepare for Verification

Select the Items to be Verified

Prepare Strategy and Resources of all types, Identify constraints, Enabling Systems, etc.

Define a Verification Action for each Verifiable Item

Define a Verification Technique for each Verifiable Item

Verification action baseline

Template:

Name: System Verification by Demonstration - BASELINE

Rationale: This technique is used to show correct operation of the submitted element against operational and observable characteristics without using physic

Verification:

Technique: **Demonstration**

Method: ☒ Automatic Rule ☐ Checklist ☐ Custom action

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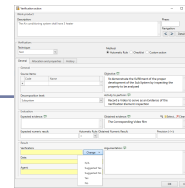
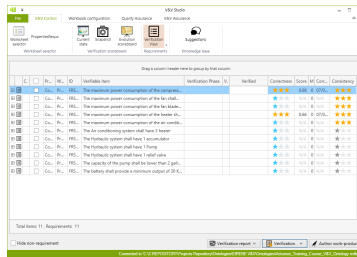
Obtained evidence: Select... Clear...

Expected numeric result: Automatic Rule: Obtained Numeric Result: Precision (-/+):

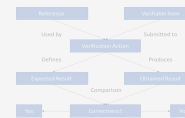
OK Cancel

Perform Verification

Connect to the Source
to collect the verifiable
items



Execute the Verification Action for
each Verifiable Item. If possible,
the computer gathers the
Information automatically



Computer applies the OK / KO
decision process based on the
standard guidelines.

Connect to the Source
to collect the verifiable
items

V&V Studio

File V&V Control Workbook configuration Quality Assurance V&V Assurance

Worksheet selector PropertiesRequ Current state Snapshot Evolution scoreboard Verification View Suggestions

Worksheet selector Verification scoreboard Requirements Knowledge base

Drag a column header here to group by that column

		C.		Pr...	W...	ID	Verifiable item	Verification Phase	V..	Verified	Correctness	Score	M	Corr...	Consistency
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the compress...				★★★★	0.66	0	07/0...	★★★★
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan shall...				★☆☆	N/A	0	N/A	★★★★
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan blade...				★☆☆	N/A	0	N/A	★★★★
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the heater sh...				★★★★	0.66	0	07/0...	★★★★
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the air conditi...				★☆☆	N/A	0	N/A	★★★★
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The Air conditioning system shall have 3 heater				★☆☆	N/A	0	N/A	★☆☆
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 accumulator				★☆☆	N/A	0	N/A	★☆☆
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 Pump				★☆☆	N/A	0	N/A	★☆☆
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 relief valve				★☆☆	N/A	0	N/A	★☆☆
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The capacity of the pump shall be lower than 2 gall...				★☆☆	N/A	0	N/A	★☆☆
+			<input type="checkbox"/>	Co...	Pr...	FRS...	The battery shall provide a minimum output of 30 K...				★☆☆	N/A	0	N/A	★☆☆

Total items: 11 , Requirements: 11

☐ Hide non-requirement

Verification report Verification Author work-product

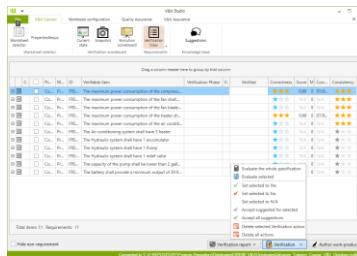
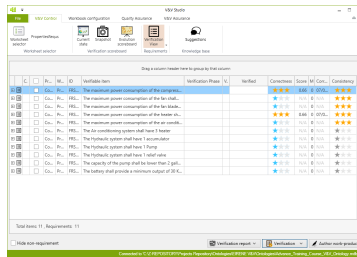
Connected to 'C:\Z-REPOSITORY\Projects Repository\Ontologies\EIRENE V&V\Ontologies\Advance_Training_Course_V&V_Ontology.mdb'

Perform Verification

Execute the Verification Action for each Verifiable Item. If possible, the computer gathers the Information automatically

Computer applies the OK / KO decision process based on the standard guidelines.

Connect to the Source to collect the verifiable items



Ask the computer to calculate the verification process (if automatic)

V&V Studio

File V&V Control Workbook configuration Quality Assurance V&V Assurance

Worksheet selector PropertiesRequis Current state Snapshot Evolution scoreboard Verification View Suggestions Knowledge base

Drag a column header here to group by that column

	C.	Pr...	W...	ID	Verifiable item	Verification Phase	V..	Verified	Correctness	Score	M	Corr...	Consistency
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the compress...				★★★★	0.66	0	07/0...	★★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan shall...				★☆☆	N/A	0	N/A	★★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan blade...				★☆☆	N/A	0	N/A	★★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the heater sh...				★★★★	0.66	0	07/0...	★★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the air condi...				★☆☆	N/A	0	N/A	★★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The Air conditioning system shall have 3 heater				★☆☆	N/A	0	N/A	★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 accumulator				★☆☆	N/A	0	N/A	★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 Pump				★☆☆	N/A	0	N/A	★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 relief valve				★☆☆	N/A	0	N/A	★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The capacity of the pump shall be lower than 2 gall...				★☆☆	N/A	0	N/A	★★★
+	<input type="checkbox"/>	Co...	Pr...	FRS...	The battery shall provide a minimum output of 30 K...				★☆☆	N/A	0	N/A	★★★

Total items: 11 , Requirements: 11

☐ Hide non-requirement

Verification report Verification Author work-product

Connected to 'C:\Z-REPOSITORY\Projects Repository\Ontologies\EIRENE V&V\Ontologies\Advance_Training_Course_V&V_Ontology.mdb'

Connect to the Source
to collect the verifiable
items

Ask the computer to
calculate the
verification process
(if automatic)



Perform Verification

The screenshot shows the 'Verification' dialog box in the 'Project Properties' window. The 'General' tab is selected. The 'Verification' section is expanded, showing 'Verification tool: VisualSVN' and 'Verification options: VisualSVN - Check'. The 'Verification' section is expanded, showing 'Verification tool: VisualSVN' and 'Verification options: VisualSVN - Check'. The 'Verification' section is expanded, showing 'Verification tool: VisualSVN' and 'Verification options: VisualSVN - Check'.

```

graph TD
    Reference[Reference] -- Used by --> VA[Verification Action]
    VFacts[Verifiable facts] -- Submitted to --> VA
    VA -- Defines --> ER[Expected result]
    VA -- Produces --> OR[Obtained Result]
    ER -- Comparison --> C[Correctness?]
    OR -- Comparison --> C
    C --> Yes[Yes]
    C --> No[No]
  
```

```

graph TD
    Information[Information] --> IK[Information-Knowledge]
    Knowledge[Knowledge] --> IK
    IK --> Beliefs[Beliefs]
    IK --> Procedures[Procedures]
    Beliefs --> ER[Epistemic Reason]
    Procedures --> UR[Utilitarian Reason]
    ER --> Comparison[Comparison]
    UR --> Comparison
    Comparison --> Yes[Yes]
    Comparison --> No[No]
    Yes --> Correctness[Correctness]
    No --> Correctness
  
```

Computer applies the OK / KO decision process based on the standard guidelines.

[illegible]

The screenshot shows the 'Verification action' dialog box. The 'Verification technique' is set to 'None'. The 'Verification' section shows 'Verification technique' as 'None' and 'Verification technique' as 'None'. The 'Verification' section shows 'Verification technique' as 'None' and 'Verification technique' as 'None'. The 'Verification' section shows 'Verification technique' as 'None' and 'Verification technique' as 'None'.



Connect to the Source
to collect the verifiable
items

Verification action

Work-product
 Description: The Air conditioning system shall have 3 heater
 Phase:
 Navigation:

Verification:
 Technique:
 Method: ☒ Automatic Rule ☐ Checklist ☐ Custom action

General | Allocation and properties | History

General:
 Source Items:

Code	Name
*	

 Objective: To demonstrate the fulfillment of the proper development of the Sub System by inspecting the property to be analyzed
 Decomposition level:
 Activity to perform: Record a Video to serve as an Evidence of the Verification Element inspection

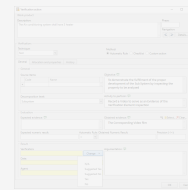
Evaluation:
 Expected evidence:
 Obtained evidence:
 Expected numeric result: = Automatic Rule: Obtained Numeric Result: Precision (-/+):

Result:
 Verification:
 Date:
 Agent:
 Argumentation:

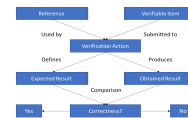
The engineer fills the
VA (Check list or
observed results)
(if manual)



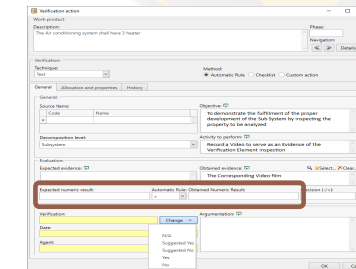
Perform Verification



Execute the Verification Action for each Verifiable Item. If possible, the computer gathers the Information automatically



Computer applies the OK / KO decision process based on the standard guidelines.



Computer automatically compares expected results with obtained results

- Suggested Yes
- Suggested No
- NA

Verification action

Work-product

Description:
The Air conditioning system shall have 3 heater

Phase:
[]

Navigation:
[<] [>] Details...

Verification:

Technique:
Test

Method:
☒ Automatic Rule
 ☐ Checklist
 ☐ Custom action

General Allocation and properties History

General:

Source Items:

Code	Name
*	

Objective:
To demonstrate the fulfillment of the proper development of the Sub System by inspecting the property to be analyzed

Decomposition level:
Subsystem

Activity to perform:
Record a Video to serve as an Evidence of the Verification Element inspection

Evaluation:

Expected evidence:
[]

Obtained evidence:
The Corresponding Video film

Expected numeric result: Automatic Rule: Obtained Numeric Result: Precision (-/+):

Result:

Verification:
[] Change

Date:
[]

Agent:
[]

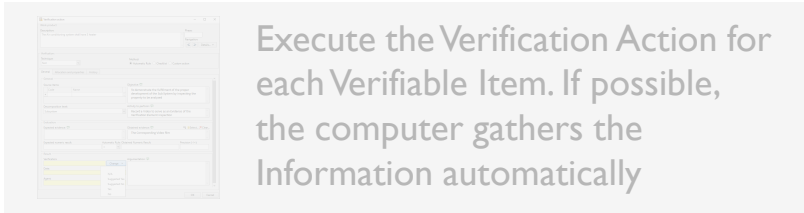
Argumentation:
[]

OK Cancel

Computer automatically compares expected results with obtained results

- Suggested Yes
- Suggested No
- NA

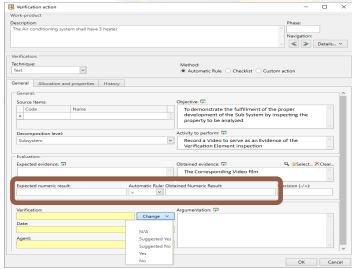
Perform Verification



Execute the Verification Action for each Verifiable Item. If possible, the computer gathers the Information automatically

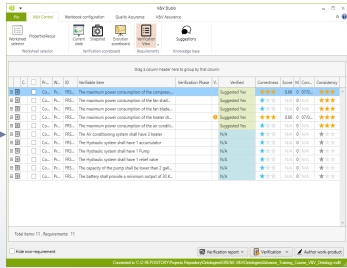


Computer applies the OK / KO decision process based on the standard guidelines.



Computer automatically compares expected results with obtained results

- Suggested Yes
- Suggested No
- NA



Full vision and management of the results is presented



V&V Studio

File V&V Control Workbook configuration Quality Assurance V&V Assurance

Worksheet selector PropertiesRequs Current state Snapshot Evolution scoreboard Verification View Suggestions Knowledge base

Drag a column header here to group by that column

	C.		Pr...	W...	ID	Verifiable item	Verification Phase	V.	Verified	Correctness	Score	M	Corr...	Consistency
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the compress...			Suggested Yes	★★★★	0.66	0	07/0...	★★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan shall...			Suggested Yes	★★★★	N/A	0	N/A	★★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the fan blade...			Suggested Yes	★★★★	N/A	0	N/A	★★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the heater sh...		!	Suggested Yes	★★★★	0.66	0	07/0...	★★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The maximum power consumption of the air conditi...			Suggested Yes	★★★★	N/A	0	N/A	★★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The Air conditioning system shall have 3 heater			N/A	★★★★	N/A	0	N/A	★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 accumulator			N/A	★★★★	N/A	0	N/A	★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 Pump			N/A	★★★★	N/A	0	N/A	★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The Hydraulic system shall have 1 relief valve			N/A	★★★★	N/A	0	N/A	★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The capacity of the pump shall be lower than 2 gall...			N/A	★★★★	N/A	0	N/A	★★★
+		<input type="checkbox"/>	Co...	Pr...	FRS...	The battery shall provide a minimum output of 30 K...			N/A	★★★★	N/A	0	N/A	★★★

Total items: 11 , Requirements: 11

☐ Hide non-requirement

Verification report Verification Author work-product

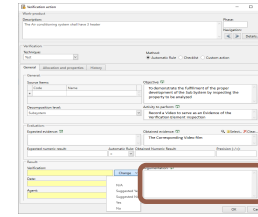
Connected to 'C:\Z-REPOSITORY\Projects Repository\Ontologies\EIRENE V&V\Ontologies\Advance_Training_Course_V&V_Ontology.mdb'

Computer automatically compares expected results with obtained results

- Suggested Yes
- Suggested No
- NA

Full vision and management of the results is presented

The VA supports the reporting of anomalies

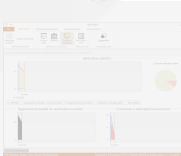


Manage Results of Verification

Manage and record discovered anomalies and evidences



Track the Verification Process and manage Configuration



Build and maintain the RTVM

A screenshot of the V&V Studio software interface showing the RTVM table. The table has columns for 'Name', 'Status', 'Version', 'Date', and 'Description'. It contains several rows of data.

Provide proper reports

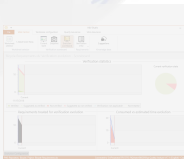


Manage Results of Verification

Manage and record
discovered anomalies and
evidences



Track the Verification
Process
and manage Configuration



Build and maintain the RTVM

Provide proper reports



Manage Results of Verification

Manage and record
discovered anomalies and
evidences



Track the Verification
Process
and manage Configuration

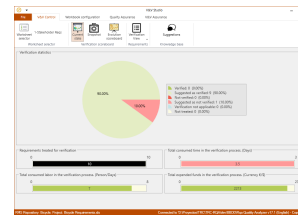


Build and maintain the RTVM

Provide proper reports



Manage Verification
Snapshots or Verification
evolution along time



Manage Results of Verification

Manage and record
discovered anomalies and
evidences



Track the Verification
Process
and manage Configuration



Build and maintain the RTVM



Provide proper reports



V&V Studio

File V&V Control Workbook configuration Quality Assurance V&V Assurance

Worksheet selector 1-Stakeholder Reqs Current state Snapshot Evolution scoreboard Verification View Suggestions Knowledge base

Drag a column header here to group by that column

	C.	Pr...	W...	ID	Text	Verification Phase	V.	Verified	Correctness	Score	M	Corr...	Consistency
	<input type="checkbox"/>	Bic...	1-...	1	The bicyclist shall be able to transport herself pedali...	1		Suggested Yes	★★★	0.47	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	2	The bicyclist shall remain clean when the road is wet	1.1		Suggested Yes	★★★★	0.00	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	3	The bicyclist shall be able to seat when pedaling			Suggested Yes	★★★★	0.00	0	21/0...	★★★★
	<input type="checkbox"/>	Bic...	1-...	4	The driver shall be able to adapt pedaling style acco...			Suggested Yes	★★★★	0.00	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	5	The driver shall be seen by the environment at any t...			Suggested No	★★★	1.90	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	6	The support staff shall be able to repair the crank gr...			Suggested Yes	★★★★	0.47	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	7	the user shall not break the bicycle due to overweight			Suggested Yes	★★★★	0.00	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	8	The reseller shall be able to give a discount of less t...			Suggested Yes	★★★★	0.00	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	9	The user shall be able to keep her body dry when th...			Suggested Yes	★★★	0.47	0	21/0...	★★★
	<input type="checkbox"/>	Bic...	1-...	10	The traffic control police shall be able to visualize th...			Suggested Yes	★★★★	0.00	0	21/0...	★★★

Total requirements: 10

☐ Hide non-requirement

Verification report Author work-product

RMS Repository: Bicycle, Project: Bicycle Requirements.xls Connected to 'D:\Proyectos\TRC\TRC-RQA\dev\BDD\IRqa Quality Analyzer v17.1 (English) - Copy.mdb'



Manage Results of Verification

Manage and record
discovered anomalies and
evidences



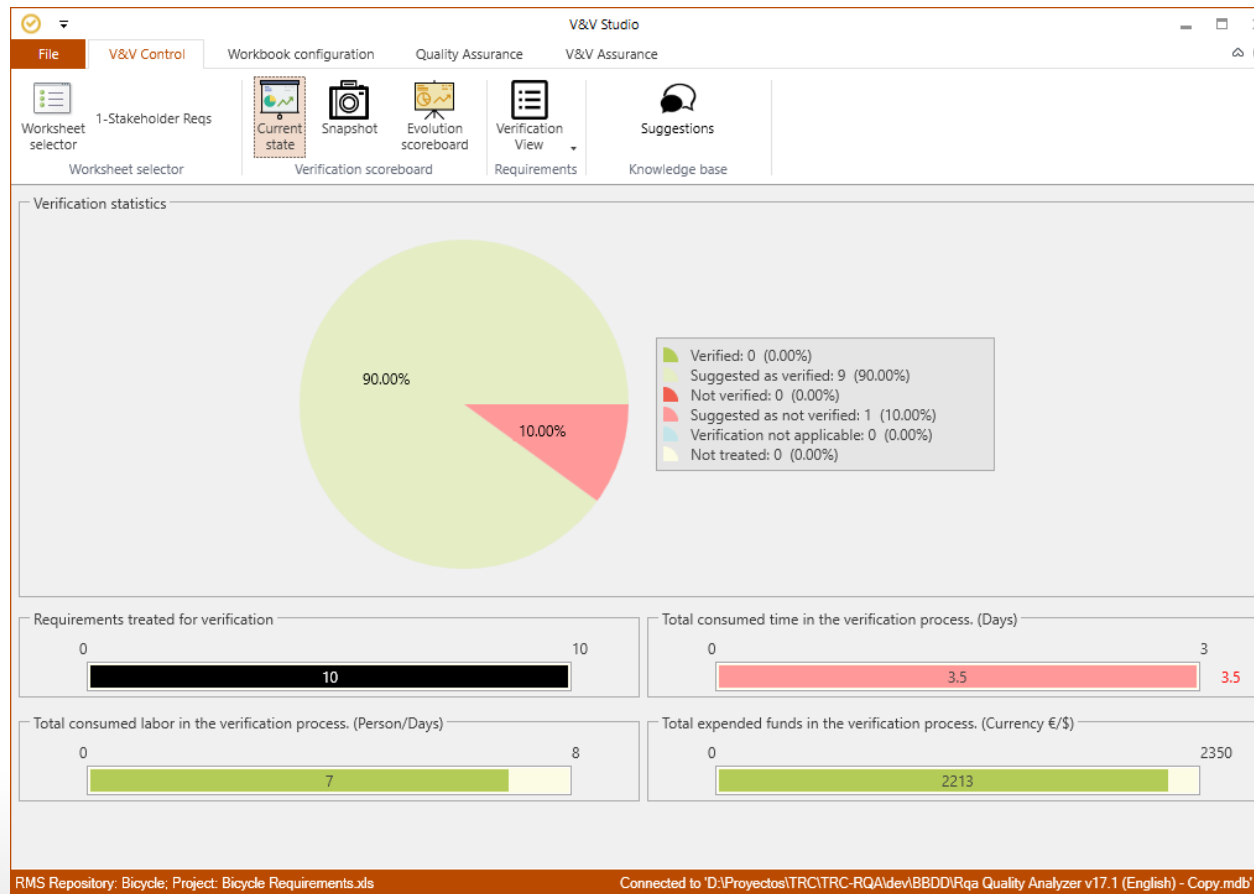
Track the Verification
Process
and manage Configuration

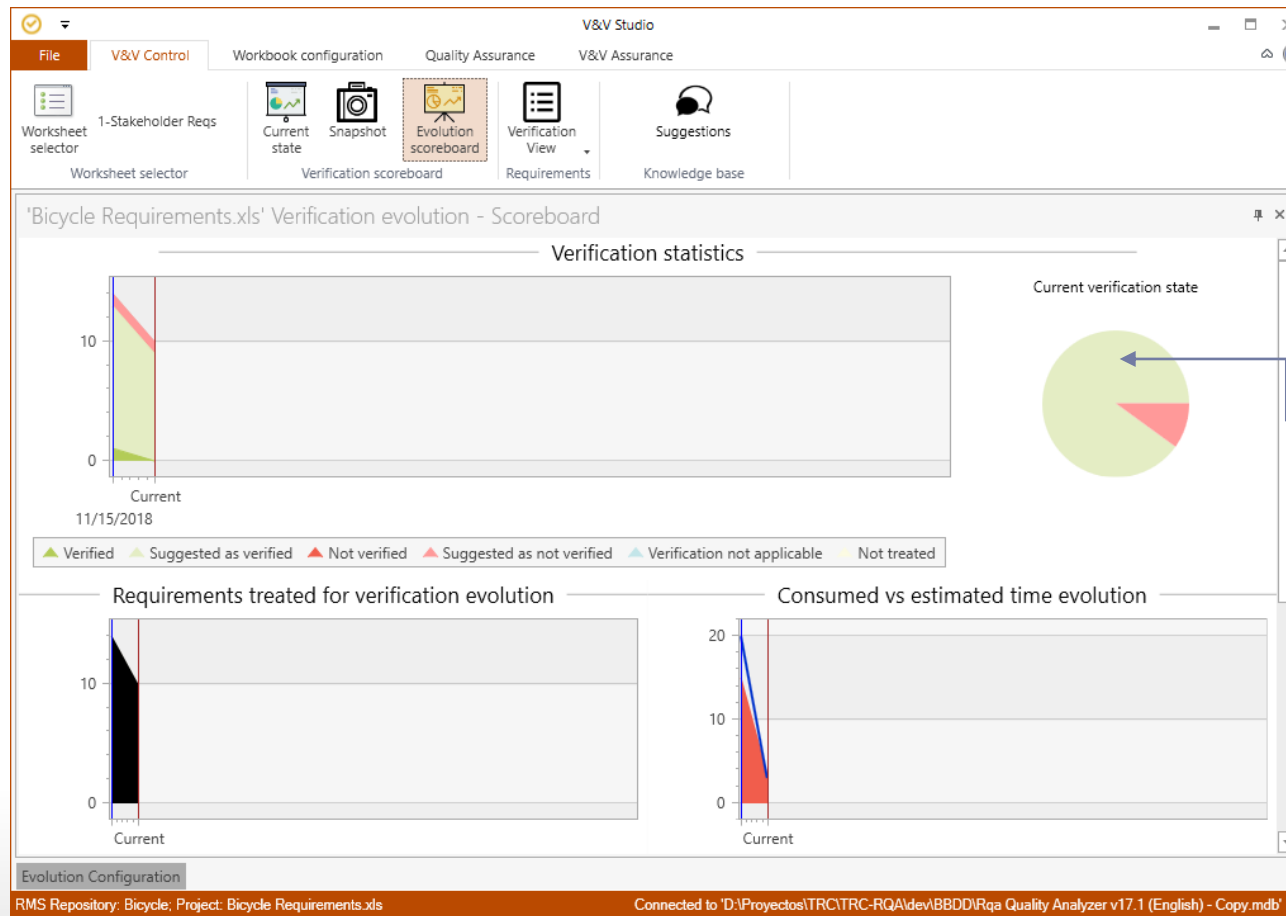


Build and maintain the RTVM



Provide proper reports





Manage Results of Verification

Manage and record discovered anomalies and evidences



Track the Verification Process and manage Configuration



Build and maintain the RTVM



Provide proper reports



Manage Results of Verification

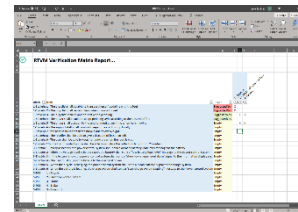
Manage and record
discovered anomalies and
evidences



Track the Verification
Process
and manage Configuration



A RTVM is created
linking Verifiable Items
and Source Items



Build and maintain the RTVM

Provide proper reports



RTVM5.xlsx - Excel

Julio Encinas

File Home Insert Draw Page Layout Formulas Data Review View Help RAT plugin for MS Excel Search

Clipboard Font Alignment Number Styles Cells Editing Ideas

F13

RTVM Verification Matrix Report...

Block	Item	Result	1 - Bicycle	2 - Electrical Power System	3 - Frame	4 - Brake
1-Stakeho 1 - The bicyclist shall be able to transport herself pedaling with the feet		SuggestedNo	X			
1-Stakeho 2 - The bicyclist shall remain clean when the road is wet		SuggestedNo	X			
1-Stakeho 3 - The bicyclist shall be able to seat when pedaling		SuggestedYes		X	X	
1-Stakeho 4 - The driver shall be able to adapt pedaling style according to the desired effort		SuggestedYes				
1-Stakeho 5 - The driver shall be seen by the environment at any time when he is moving		SuggestedYes		X	X	
1-Stakeho 6 - The support staff shall be able to repair the crank group locally		Empty				
1-Stakeho 7 - the user shall not break the bicycle due to overweight		Empty				
1-Stakeho 8 - The reseller shall be able to give a discount of less than 30%		Empty				
1-Stakeho 9 - The user shall be able to keep her body dry when the road is wet		Empty				
1-Stakeho 10 - The traffic control police shall be able to visualize the reflection lamps from 20 meters.		Empty				
3-Electric 1 - every 4 seconds, the power control system shall send a demand battery load level message to the battery		Empty				
3-Electric 2 - when the voltage level is below 11,5V, the battery shall send a "low battery load level" message to the power control system.		Empty				
3-Electric 3 - if the battery is low, the power control system shall send a "show low energy level alarm" signal to the information display syst		Empty				
3-Electric 4 - The user must plug in the bicycle to the electrical power		Empty				
3-Electric 5 - When the bicycle is charging, the power control system shall send a "Load battery" signal to the charge system.		Empty				
3-Electric 6 - When the battery is loading, the charge system shall send a "Stop charge system Loading" message to the Power control system		Empty				
5-PBS 1 - Bicycle		Empty				
5-PBS 2 - Electrical Power System		Empty				
5-PBS 3 - Frame		Empty				
5-PBS 4 - Brake		Empty				
5-PBS 5 - Gearshift		Empty				

RTVM

Manage Results of Verification

Manage and record discovered anomalies and evidences



Track the Verification Process and manage Configuration



Build and maintain the RTVM



Provide proper reports



Manage Results of Verification

Manage and record
discovered anomalies and
evidences

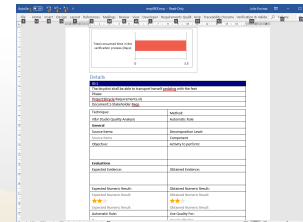


Track the Verification
Process
and manage Configuration



Build and maintain the RTVM

All reports can be
produced in MS Word



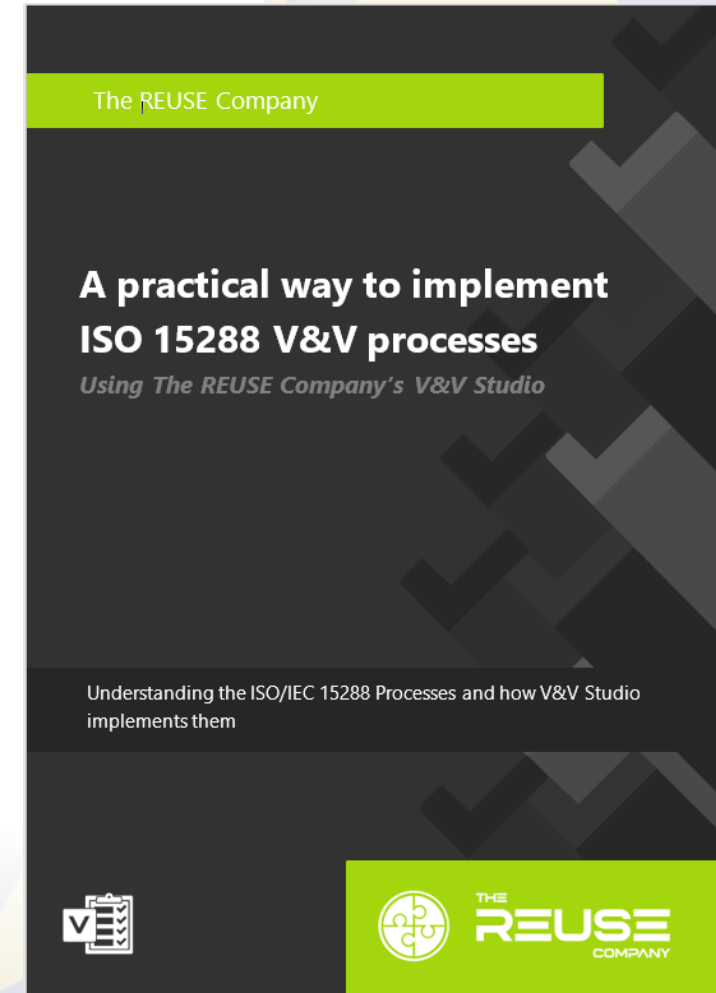
Provide proper reports

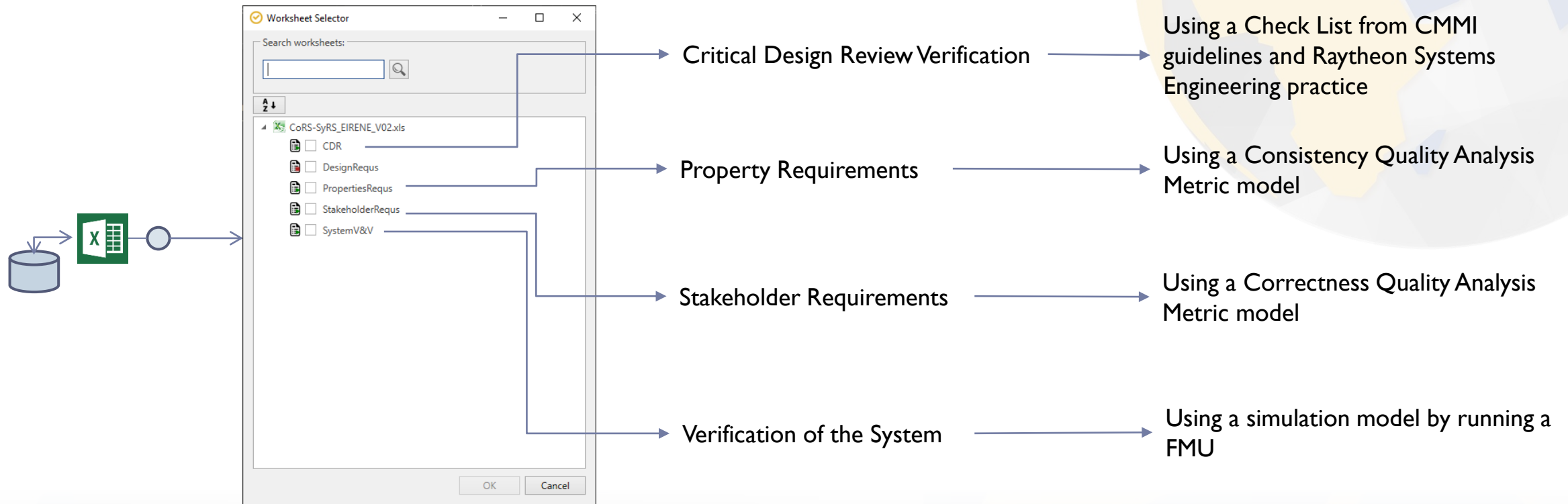


Manage Results of Verification

The screenshot displays the V&V Studio software interface. The top ribbon includes tabs for File, Home, Insert, Design, Layout, References, Mailings, Review, View, Developer, Requirements, Quality, Help, Traceability, Document, Verification & Validation, Tell me, and a search bar. The 'Verification & Validation' tab is active, showing two main sections: 'Verification' and 'Validation'. Each section contains a 'Verification Project' or 'Validation Project' dropdown, a 'Verification Document' or 'Validation Document' dropdown, and a 'Score' indicator (30%). Below these are icons for 'Verification State Diagram', 'Verification Details List', and 'Verification View'. The main workspace is a large white area for editing. The bottom right corner shows a small preview of the 'Verification State Diagram'.

- Feel free to ask for the philosophy book
 - “A practical way to implement ISO 15288 V&V processes, Using the REUSE Company’s V&V Studio”
- Only delivered on demand
- Get use of a specific OFFER CODE for Piloting the V&V Studio
 - POCSAH14





- **Writing Perfect Textual Requirements in Capella MBSE Tool: RAT – Authoring Tools providing real-time CCC Assessment and Consistency with the Underlying Model**
- This webinar presents an add-on to Capella that follows all the principles and features of the RAT - Authoring Tools on top of Requirements Modelling Tools (RMS), but now on top of a Modelling tool like Capella; thus enhancing a seamless consistency between textual requirements and models (model requirements).
- The webinar will include a demo of this new add-on, showing the following features:
 - Assisted authoring of requirements through pattern-based auto-completion
 - Real-time quality assessment
 - Maintenance of relations between textual and model-based requirements, and capitalization of links for change tracking
 - Synchronization of textual requirements: a round-trip approach between Capella and other external Requirements Management Systems

Dates:

- Jun 16 and 18, 2020





THANK YOU

GRACIAS
ARIGATO
SHUKURIA
JUSPAXAR
DANKSCHEEN
TASHAKKUR ATU
YAQHANYELAY
SUKSAMA
EKGHMET
BIYAN
SHUKRIA
TINGKI
MERCY
BOLZIN
MERCI
GOZAIMASHITA
EFCHARISTO
KOMPASUNIDA
MAAKE
GRAZIE
MEHRBANI
PALDIES
TAVTAPUCH
MEDAWAGSE
BANKA
DANKA
CHALTU
NUHUN
SNACHALHUYA
WABEEJA
MAITEKA
HUI
YUSPAGARATAM
HAI
UNALCHEESI
HATIR
SER
ENOLU
SUKOMO
MAKETAI
MINMONCHAR



contact@reusecompany.com

